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EFFECT OF HABITAT DISTURBANCES ON THE COLLEMBOLAN POPULATIONS OF A CASSAVA PLANTATION IN ILE-IFE, NIGERIA.

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SUMMARY: Soil and litter-inhabiting collembolan populations were monitored in a secondary regrowth forest and the adjoining plot that was manually cleared, burned and cultivated with cassava for a period of 12 months. These habitat disturbances were deleterious to all soil-inhabiting Collembola but most litter-inhabiting collembolan genera adapted to the new conditions in the disturbed plot. *Songhaica* sp. increased significantly in numbers while *Ceratrimeria* sp. decreased significantly in numbers.

KEY WORDS: Soil, Collembola, secondary regrowth forest, cassava plantation, habitat disturbances, selective influence, decomposition processes

INTRODUCTION

In undisturbed soils in Nigeria, Acarina are more abundant than Collembola (Lasebikan, 1979a), but the reverse pattern of abundance is found in cultured plots, where weeding is done manually (Lasebikan, 1979b). In addition, the number of species and their relative abundances are indicative of different degrees of habitat disturbance. This study investigated the effects of some traditional farming practices in Nigeria on collembolan populations. A comparison was made between two plots, one of which was cleared and used for cassava culture. Results for Acarina have been presented earlier (Badejo and Lasebikan, 1988).

MATERIALS AND METHODS

Two sites were studied, denoted by A and B. The two sites had a similar secondary regrowth forest, until the vegetation of plot B was cleared, burned and raked, and the plot was cultivated with cassava. Full details on the site of study, soil sampling and extraction procedures have already been provided by Badejo and Lasebikan (1988).

In addition to core sampling for soil-inhabiting Collembola, the surface and litter-inhabiting collembolan species of each plot were sampled by pitfall traps in order to investigate the extent to which their populations were affected by the disturbances. The trap used was a plastic dish with a diameter of 10.5 cm at the rim. In each plot, eight traps were sunk into the soil with their rims flushed with the soil surface, each trap being placed within each of the eight 2.5 m x 5 m grids into which each plot had been previously divided (see Badejo and Lasebikan, 1988). Formalin (5%) was poured into each trap to a depth of few centimeters. The traps were removed after twenty-four hours and the contents of each trap emptied in the laboratory into a petri-dish for sorting, identification and counting under a dissecting microscope. Identification of Collembola was carried out to generic level. The data were transformed to log (x+1) before using the Student's t-test to compare site differences both before disturbance and during cultivation of plot B.

RESULTS AND DISCUSSION

16 genera of Collembola were recorded during this study but only ten were present in numbers high enough to permit statistical comparison of data from the two plots. In Table 1, only the genera for which significant difference exits between their numbers in the two plots are presented. The differences between the numbers of each genus recorded before

Table 1. The means ($\pm$ std. error) of some Collembola genera in the two plots before disturbance of plot B (October 1982 to February 1983) and during cultivation of plot B (February 1983 to March 1984). Data transformed to log (x+1)

	SOIL				LITTER			
	Before disturbance		During cultivation		Before disturbance		During cultivation	
Genus	Forest (A)	Forest (B)	Forest (A)	Cassava (B)	Forest (A)	Forest (B)	Forest (A)	Cassava (B)
Ceratrimeria	0.10(0.10)	0.19(0.19)	0.03(0.03)	0.06(0.04)	0.22(0.13)	0.08(0.00)	0.65(0.18)	0.22(0.08)*
Isotomodes	0.54(0.20)	0.33(0.16)	0.57(0.13)	0.10(0.06)*	0.00(0.00)	0.00(0.00)	0.02(0.02)	0.04(0.03)
Paronella	0.10(0.10)	0.14(0.14)	0.58(0.13)	0.12(0.07)*	0.38(0.23)	0.79(0.20)	0.68(0.14)	0.50(0.16)
Lepidocrytus	0.38(0.23)	0.34(0.21)	0.81(0.12)	0.27(0.09)*	1.10(0.31)	1.12(0.21)	1.64(0.17)	1.70(0.17)
Songhaica	0.00(0.00)	0.00(0.00)	0.02(0.02)	0.06(0.04)	0.00(0.00)	0.00(0.00)	0.16(0.08)	0.40(0.14)*

* Difference significant at 0.05 level, all other mean differences not significant.

disturbance were not significant. This is expected because it is widely accepted that there is little or no difference in species composition and numbers of microarthropods in habitats with similar soil and vegetation types within the same geographic area (Olivier and Ryke, 1969; Ghilarov and Perel, 1971; Speight and Lawton, 1976).

The clearing and burning of plot B has undoubtedly led to the destruction of the eggs of Collembola in the top soil on the one hand and the plant litter, humus and fungal spores which either constitute a habitat or food resource for many collembolan species on the other hand. These were probably responsible for the lower densities of soil Collembola recorded in the cassava plot when compared with the undisturbed plot A. *Isotomodes* sp., *Paronella* sp. and *Lepidocyrtus* sp. whose densities were significantly less in the cassava plot than in the undisturbed forest (see Table 1) were probably more affected by the drastic changes referred to above than the other genera.

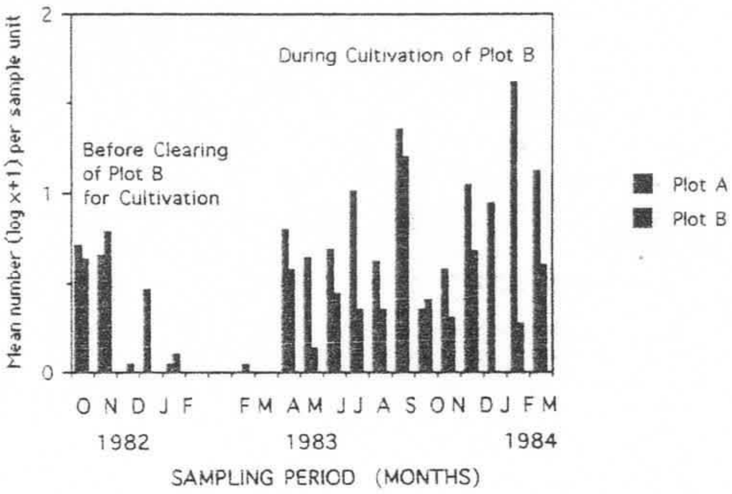

Fig. 1. Mean number per sampling unit, transformed as log (x+1), of soil Collembola recorded from the experimental plots during the sampling period. (Mean based on eight soil cores per occasion).

The low populations of Collembola in the soil of both plots just before and immediately after disturbance of plot B (Fig.1) is probably due to the fact that sampling was done in the dry period when many species may have migrated to more humid soil horizons below the surface (Butcher *et al.* 1971). More Collembola was extracted in the dry season of 1983-84 than in the dry season of 1982-83 probably because of an unusual rainfall which occurred in December 1983 (see Badejo and Lasebikan, 1988) and which must have stimulated the activity of the collembolan species. This observation is also in agreement with the findings of various workers as reviewed by Christiansen (1964), who reported that Collembola must live in atmospheres near the point of saturation.

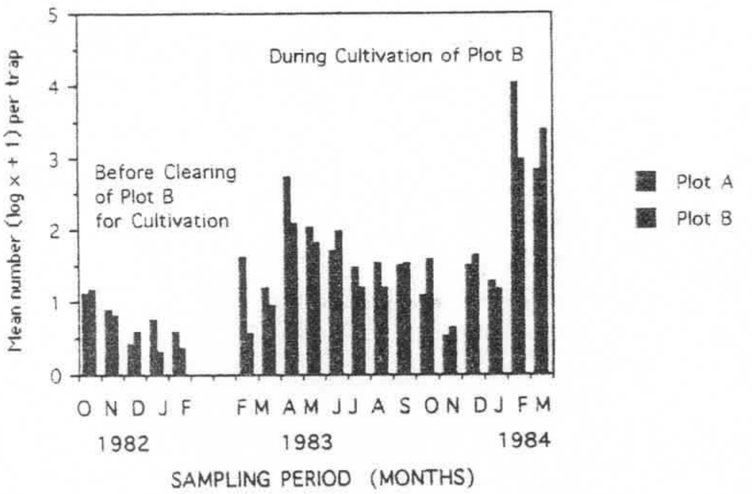

Fig 2. Mean number per sampling unit, transformed as log (x+1), of litter-dwelling Collembola trapped from the experimental plots during the sampling period. (Mean based on eight soil cores per occasion).

The pitfall trapping results allow a comparison of the surface activity of each collembola species in both plots. Unlike the soil situation, Collembola was trapped in plot B just after clearing and burning. They were also caught in fairly large numbers during the subsequent sampling occasions (Fig 2). These observations suggest a continous influx of Collembola into plot B from the adjoining forest plots and their ability to colonize cleared and cultivated areas.

The species whose numbers in the cassava plot were not significantly different from the numbers in the undisturbed forest include *Rhodanella* sp. *Dicranocentrus* sp., *Dicyrtoma* sp., *Stenognathriopes* sp. and *Sminthurinus* sp. These species probably possess substantial ecological plasticity which enabled them to adapt to conditions in the two plots. It is most probable that *Songhaica* sp., a predominant litter dweller, which was more abundant in plot B than Plot A during the period of disturbance (Table 1) is a phytophagous species whose activity increased in plot B as a result of the fresh weeds present there.

Rhodanella sp. was responsible for the extremely large numbers of Collembola that were caught by pitfall traps in the early rainy season. Large swarms of this species were seen on the floor of the forest and cassava plots most especially after rainstorms. This observation has also been reported by Lasebikan *et al.* (1985).

The trapping as well as the core sampling results show that habitat disturbances associated with traditional farming practice in Nigeria have selectively deleterious effects on different species of soil and litter inhabiting Collembola. The selective influence of farming practices on soil arthropod populations has also been reported by Critchley *et al.* (1979), Lasebikan (1979b) and Badejo and Lasebikan (1988).

Just as Collembola numbers were affected by the habitat disturbances in the cassava plot, so also will the roles they play in decomposition processes be affected. If the relative contributions of each species to these decomposition processes are known, the full implications of the effects of habitat disturbances on Collembola in the cassava plot will be known.

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